


# IRF840/FI
# IRF841/FI

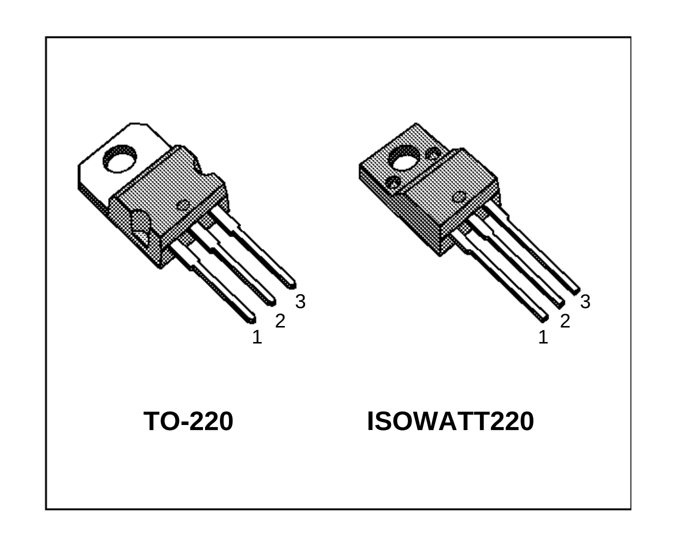
## N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

| TYPE | $V_{DSS}$ | $R_{DS(on)}$ | $I_D$ |
|---|---|---|---|
| IRF840 | 500 V | < 0.85 Ω | 8 A |
| IRF840FI | 500 V | < 0.85 Ω | 4.5 A |
| IRF841 | 450 V | < 0.85 Ω | 8 A |
| IRF841FI | 450 V | < 0.85 Ω | 4.5 A |

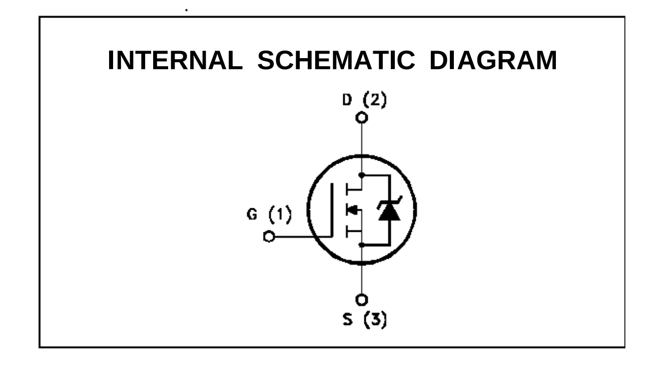
- TYPICAL $R_{DS(on)}$ = 0.74 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100$^o$C

### APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT




### INTERNAL SCHEMATIC DIAGRAM




### ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value IRF 840 | 841 | 840FI | 841FI | Unit |
|---|---|---|---|---|---|---|
| $V_{DS}$ | Drain-source Voltage ($V_{GS}$ = 0) | 500 | 450 | 500 | 450 | V |
| $V_{DGR}$ | Drain- gate Voltage ($R_{GS}$ = 20 kΩ) | 500 | 450 | 500 | 450 | V |
| $V_{GS}$ | Gate-source Voltage | ± 20 | | | | V |
| $I_D$ | Drain Current (cont.) at $T_c$ = 25 $^o$C | 8 | 8 | 4.5 | 4.5 | A |
| $I_D$ | Drain Current (cont.) at $T_c$ = 100 $^o$C | 5.1 | 5.1 | 2.8 | 2.8 | A |
| $I_{DM}$(•) | Drain Current (pulsed) | 32 | 32 | 32 | 32 | A |
| $P_{tot}$ | Total Dissipation at $T_c$ = 25 $^o$C | 125 | | 40 | | W |
| | Derating Factor | 1 | | 0.32 | | W/$^o$C |
| $V_{ISO}$ | Insulation Withstand Voltage (DC) | — | | 2000 | | |
| $T_{stg}$ | Storage Temperature | -65 to 150 | | | | $^o$C |
| $T_j$ | Max. Operating Junction Temperature | 150 | | | | $^o$C |

(•) Pulse width limited by safe operating area

## THERMAL DATA

| | | TO-220 | ISOWATT220 | |
|---|---|---|---|---|
| $R_{thj-case}$ | Thermal Resistance Junction-case Max | 1 | 3.12 | $^oC/W$ |
| $R_{thj-amb}$ | Thermal Resistance Junction-ambient Max | 62.5 | | $^oC/W$ |
| $R_{thc-s}$ | Thermal Resistance Case-sink Typ | 0.5 | | $^oC/W$ |
| $T_l$ | Maximum Lead Temperature For Soldering Purpose | 300 | | $^oC$ |

## AVALANCHE CHARACTERISTICS

| Symbol | Parameter | Max Value | Unit |
|---|---|---|---|
| $I_{AR}$ | Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by $T_j$ max, $\delta < 1\%$) | 8 | A |
| $E_{AS}$ | Single Pulse Avalanche Energy (starting $T_j = 25\ ^oC$, $I_D = I_{AR}$, $V_{DD} = 25$ V) | 510 | mJ |
| $E_{AR}$ | Repetitive Avalanche Energy (pulse width limited by $T_j$ max, $\delta < 1\%$) | 13 | mJ |
| $I_{AR}$ | Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\ ^oC$, pulse width limited by $T_j$ max, $\delta < 1\%$) | 5.1 | A |

## ELECTRICAL CHARACTERISTICS ($T_{case} = 25\ ^oC$ unless otherwise specified)

OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source Breakdown Voltage | $I_D = 250\ \mu A$ $V_{GS} = 0$<br>for **IRF840/840FI**<br>for **IRF841/841FI** | <br>500<br>450 | | | <br>V<br>V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current ($V_{GS} = 0$) | $V_{DS}$ = Max Rating<br>$V_{DS}$ = Max Rating x 0.8 $T_c = 125\ ^oC$ | | | 250<br>1000 | μA<br>μA |
| $I_{GSS}$ | Gate-body Leakage Current ($V_{DS} = 0$) | $V_{GS} = \pm 20$ V | | | ± 100 | nA |

ON (∗)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}$ $I_D = 250\ \mu A$ | 2 | 3 | 4 | V |
| $R_{DS(on)}$ | Static Drain-source On Resistance | $V_{GS} = 10V$ $I_D = 4.4$ A | | 0.74 | 0.85 | Ω |
| $I_{D(on)}$ | On State Drain Current | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10$ V | 8 | | | A |

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ (∗) | Forward Transconductance | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 4.4$ A | 4.9 | 6 | | S |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input Capacitance<br>Output Capacitance<br>Reverse Transfer Capacitance | $V_{DS} = 25$ V f = 1 MHz $V_{GS} = 0$ | | 1100<br>190<br>80 | 1500<br>240<br>110 | pF<br>pF<br>pF |





## ELECTRICAL CHARACTERISTICS (continued)

SWITCHING RESISTIVE LOAD

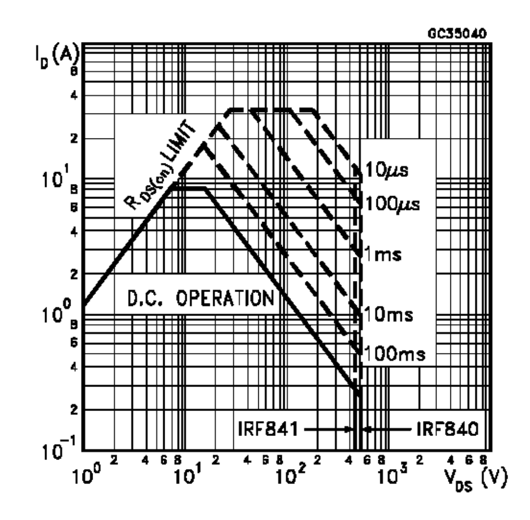
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on Time | $V_{DD}$ = 200 V  $I_D$ = 4 A | | 40 | 50 | ns |
| $t_r$ | Rise Time | $R_i$ = 4.7 Ω | | 35 | 43 | ns |
| $t_{d(off)}$ | Turn-off Delay Time | (see test circuit) | | 80 | 100 | ns |
| $t_f$ | Fall Time | | | 20 | 25 | ns |
| $Q_g$ | Total Gate Charge | $I_D$ = 8 A  $V_{GS}$ = 10 V | | 75 | 95 | nC |
| $Q_{gs}$ | Gate-Source Charge | $V_{DD}$ = Max Rating x 0.8 | | 9 | | nC |
| $Q_{gd}$ | Gate-Drain Charge | (see test circuit) | | 39 | | nC |

SOURCE DRAIN DIODE

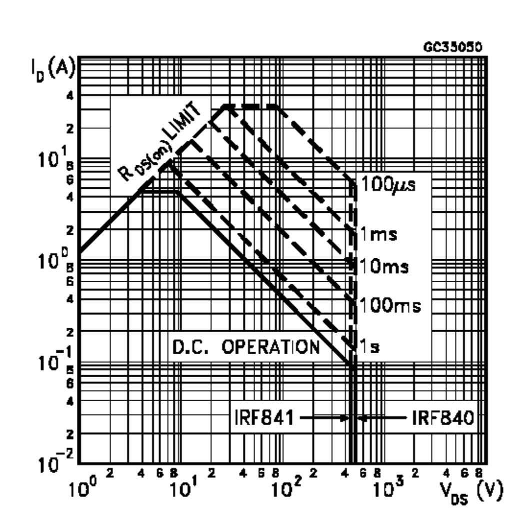
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$ | Source-drain Current | | | | 8 | A |
| $I_{SDM}$(•) | Source-drain Current (pulsed) | | | | 32 | A |
| $V_{SD}$ (∗) | Forward On Voltage | $I_{SD}$ = 8 A  $V_{GS}$ = 0 | | | 2 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_{SD}$ = 8 A  di/dt = 100 A/μs<br>$V_{DD}$ = 100 V  $T_j$ = 150 °C | | 700 | | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | 12 | | μC |

(∗) Pulsed: Pulse duration = 300 μs, duty cycle 1.5 %
(•) Pulse width limited by safe operating area

Safe Operating Area for TO-220



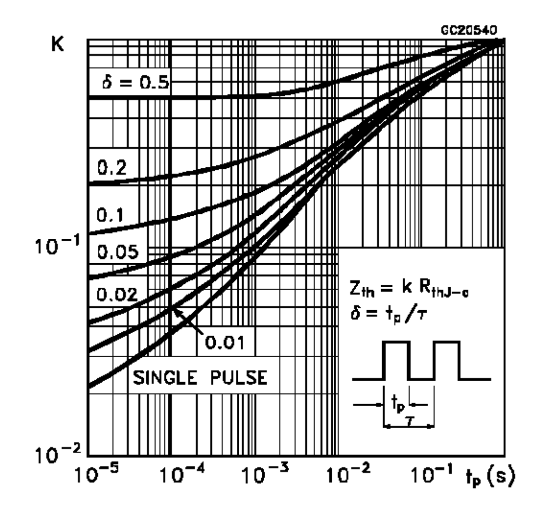

Safe Operating Area for ISOWATT220



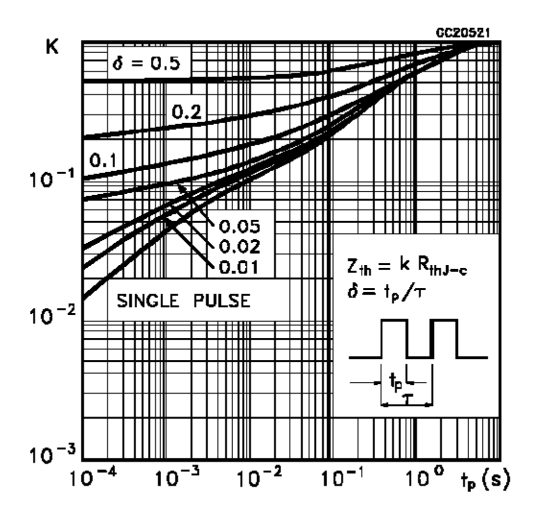




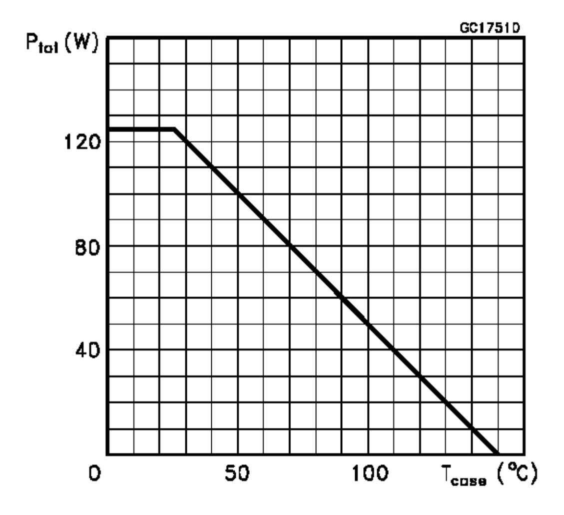

Thermal Impedance for TO-220



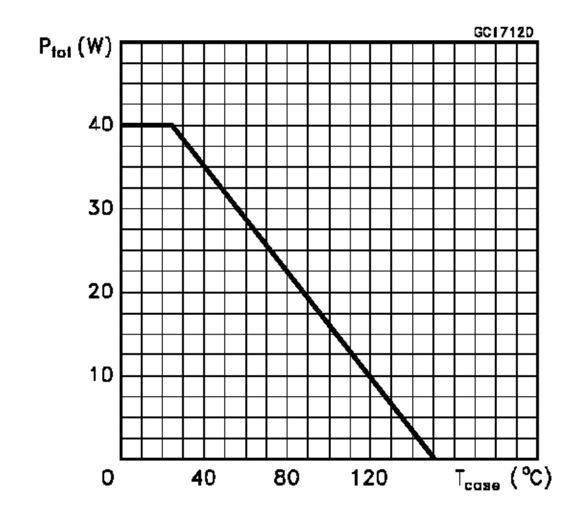

Thermal Impedance for ISOWATT220



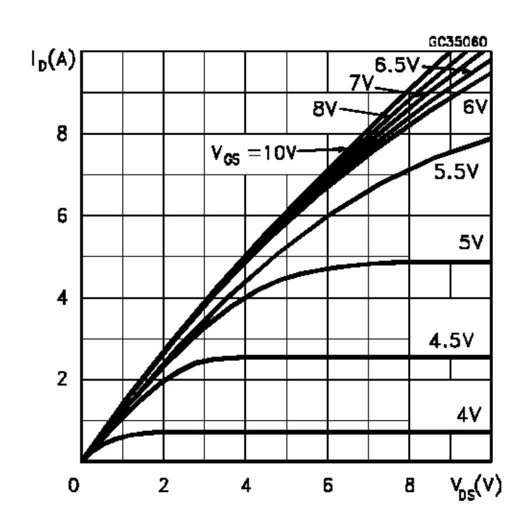

Derating Curve for TO-220



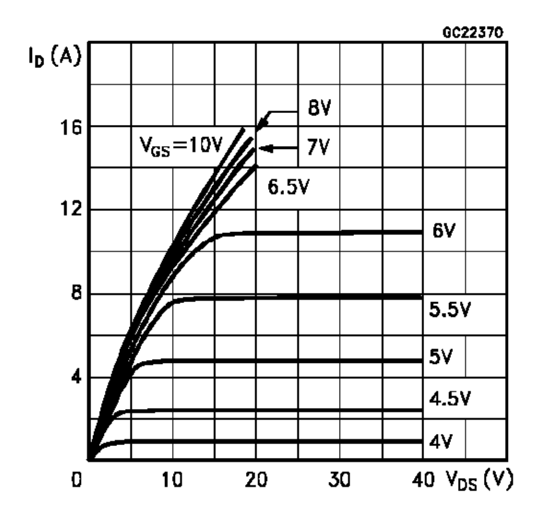

Derating Curve for ISOWATT220



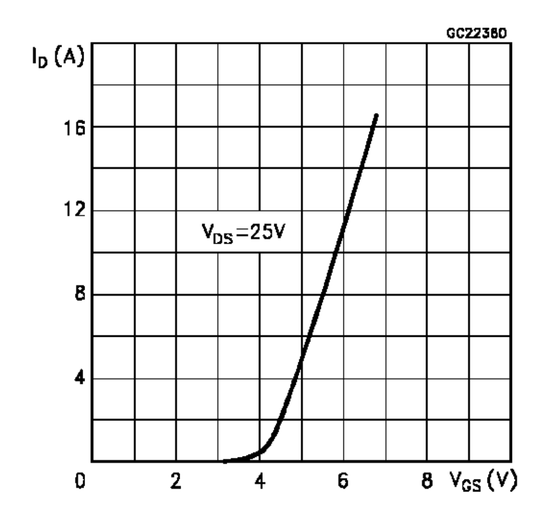

Output Characteristics



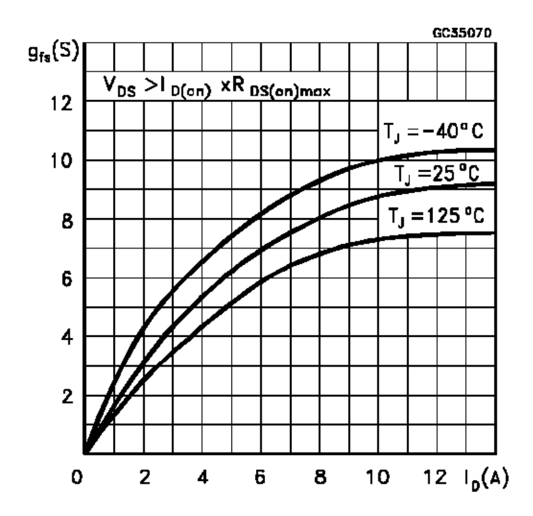

Output Characteristics



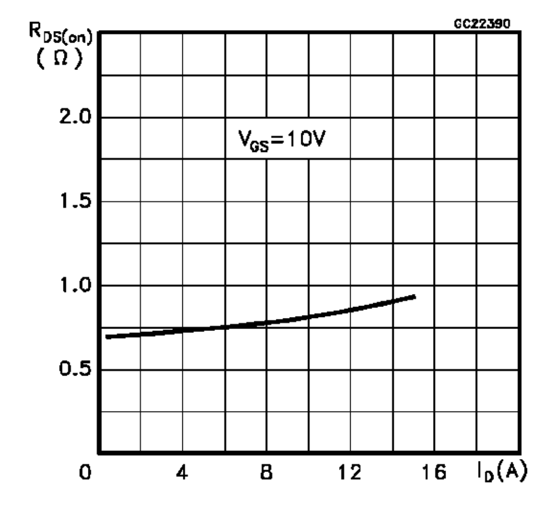
Transfer Characteristics



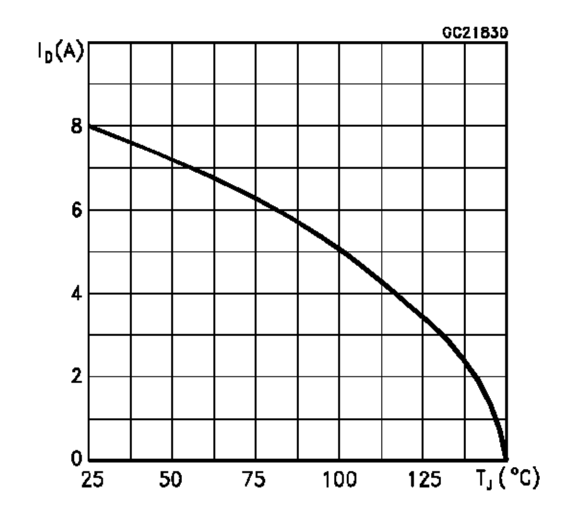

Transconductance



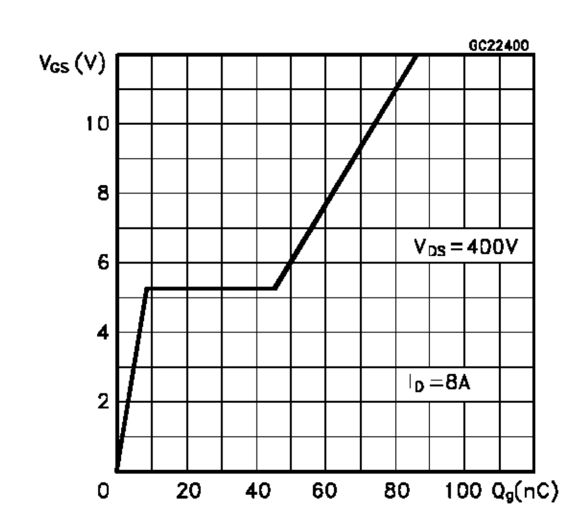

Static Drain-source On Resistance



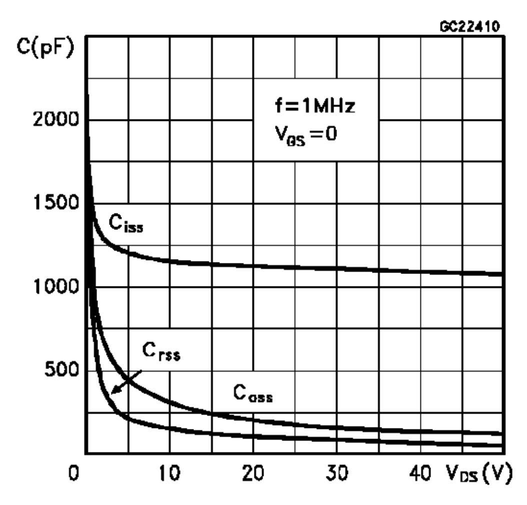

Maximum Drain Current vs Temperature




Gate Charge vs Gate-source Voltage



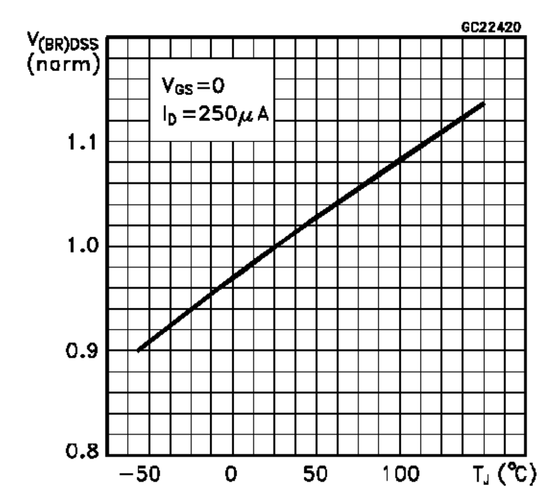

Capacitance Variations



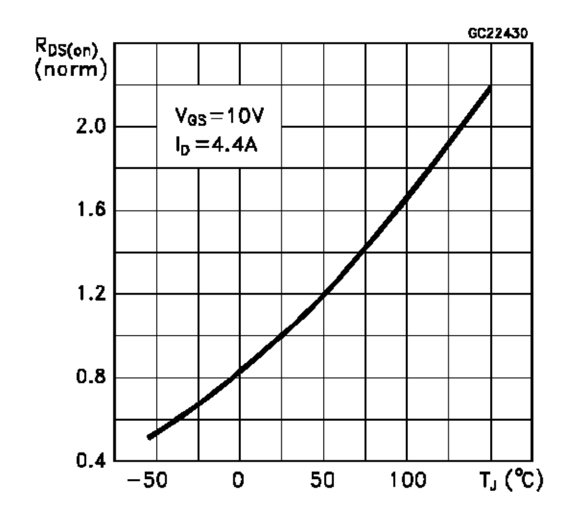




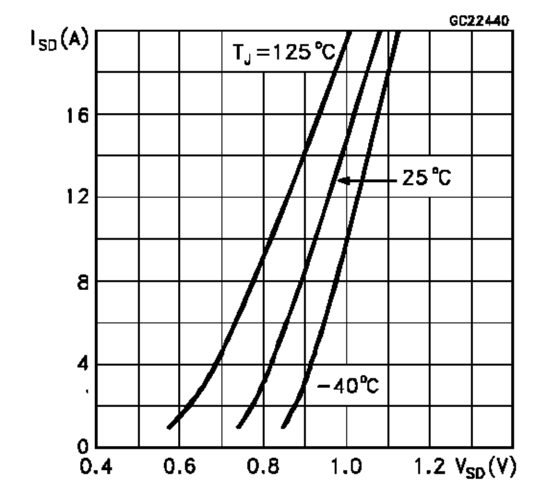

Normalized Breakdown Voltage vs Temperature



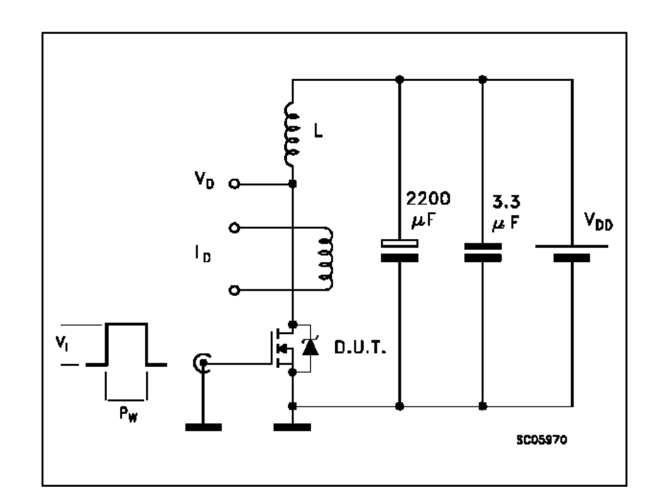

Normalized On Resistance vs Temperature



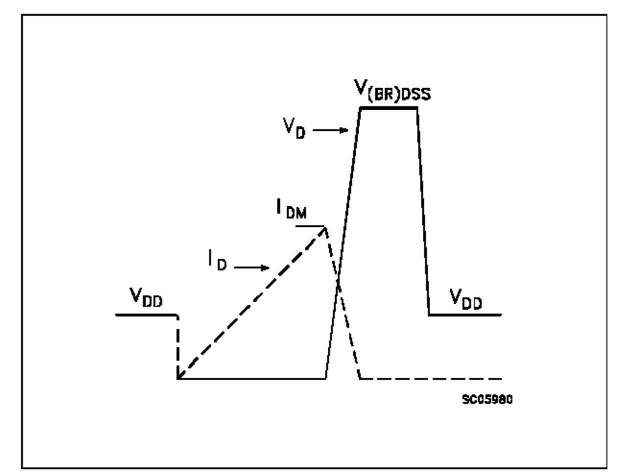

Source-drain Diode Forward Characteristics




Unclamped Inductive Load Test Circuit



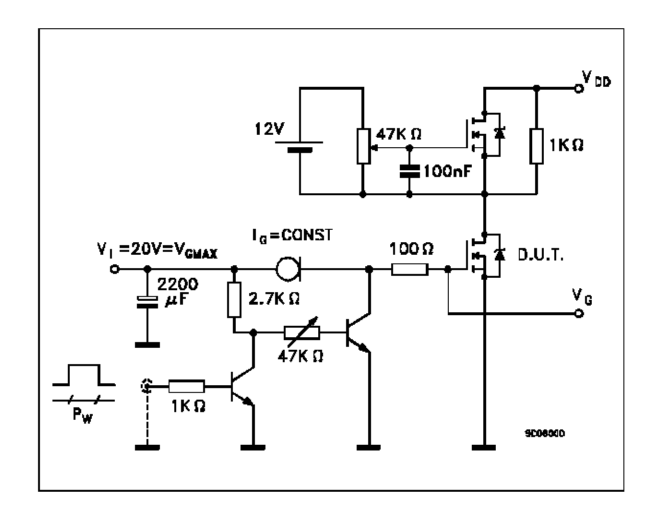

Unclamped Inductive Waveforms



Switching Time Test Circuit

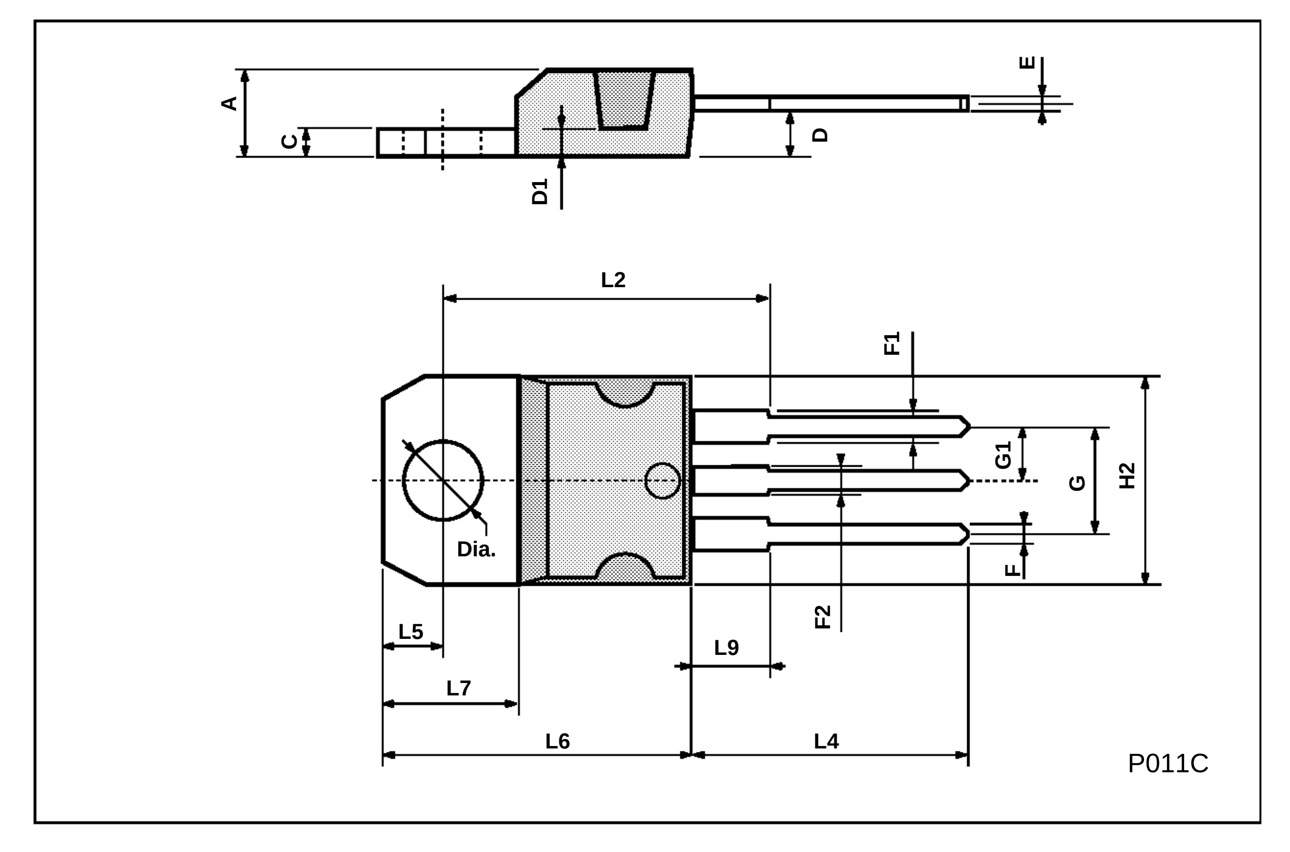
V_GS
P_W
V_D
R_G
R_L
D.U.T.
2200 μF
3.3 μF
V_DD

Gate Charge Test Circuit



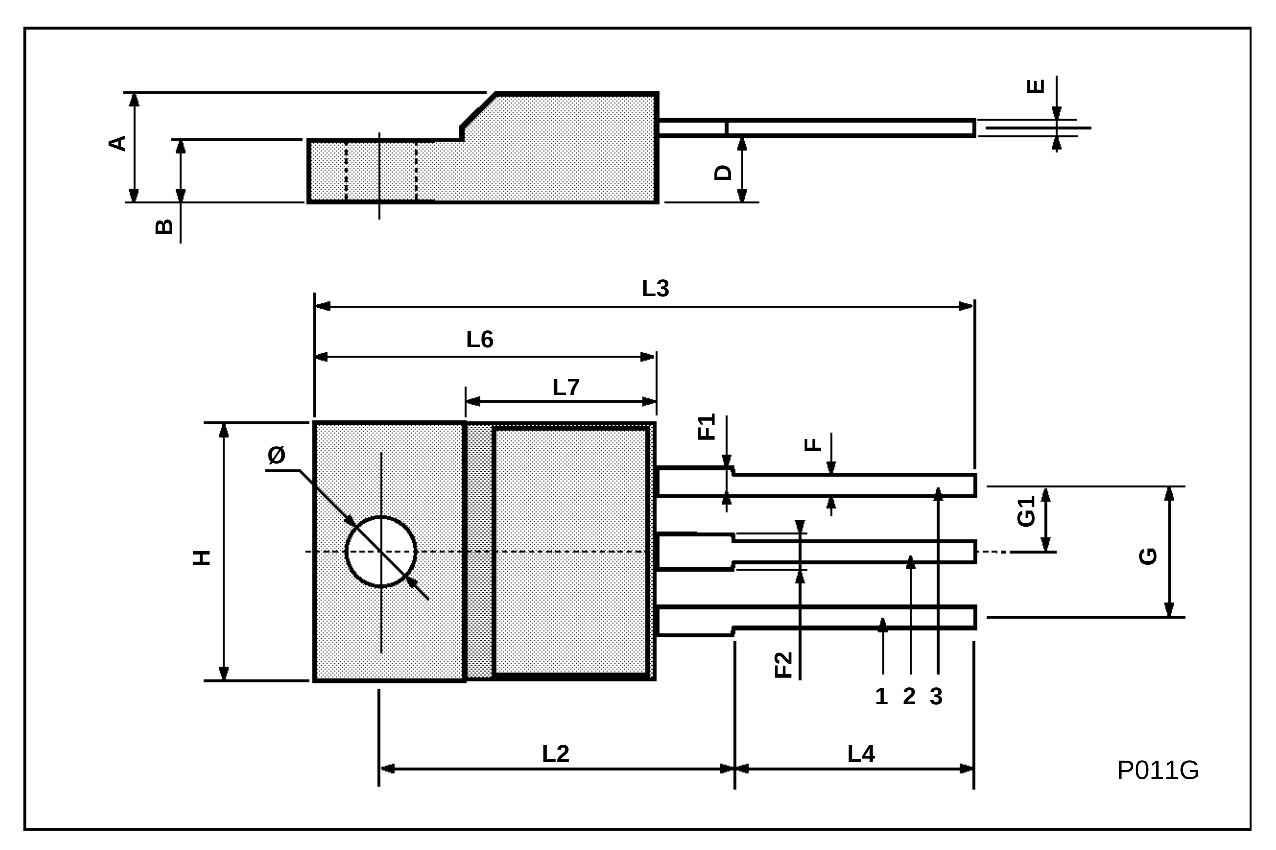
## TO-220 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| C | 1.23 | | 1.32 | 0.048 | | 0.051 |
| D | 2.40 | | 2.72 | 0.094 | | 0.107 |
| D1 | | 1.27 | | | 0.050 | |
| E | 0.49 | | 0.70 | 0.019 | | 0.027 |
| F | 0.61 | | 0.88 | 0.024 | | 0.034 |
| F1 | 1.14 | | 1.70 | 0.044 | | 0.067 |
| F2 | 1.14 | | 1.70 | 0.044 | | 0.067 |
| G | 4.95 | | 5.15 | 0.194 | | 0.203 |
| G1 | 2.4 | | 2.7 | 0.094 | | 0.106 |
| H2 | 10.0 | | 10.40 | 0.393 | | 0.409 |
| L2 | | 16.4 | | | 0.645 | |
| L4 | 13.0 | | 14.0 | 0.511 | | 0.551 |
| L5 | 2.65 | | 2.95 | 0.104 | | 0.116 |
| L6 | 15.25 | | 15.75 | 0.600 | | 0.620 |
| L7 | 6.2 | | 6.6 | 0.244 | | 0.260 |
| L9 | 3.5 | | 3.93 | 0.137 | | 0.154 |
| DIA. | 3.75 | | 3.85 | 0.147 | | 0.151 |



# ISOWATT220 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.4 | | 4.6 | 0.173 | | 0.181 |
| B | 2.5 | | 2.7 | 0.098 | | 0.106 |
| D | 2.5 | | 2.75 | 0.098 | | 0.108 |
| E | 0.4 | | 0.7 | 0.015 | | 0.027 |
| F | 0.75 | | 1 | 0.030 | | 0.039 |
| F1 | 1.15 | | 1.7 | 0.045 | | 0.067 |
| F2 | 1.15 | | 1.7 | 0.045 | | 0.067 |
| G | 4.95 | | 5.2 | 0.195 | | 0.204 |
| G1 | 2.4 | | 2.7 | 0.094 | | 0.106 |
| H | 10 | | 10.4 | 0.393 | | 0.409 |
| L2 | | 16 | | | 0.630 | |
| L3 | 28.6 | | 30.6 | 1.126 | | 1.204 |
| L4 | 9.8 | | 10.6 | 0.385 | | 0.417 |
| L6 | 15.9 | | 16.4 | 0.626 | | 0.645 |
| L7 | 9 | | 9.3 | 0.354 | | 0.366 |
| Ø | 3 | | 3.2 | 0.118 | | 0.126 |




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